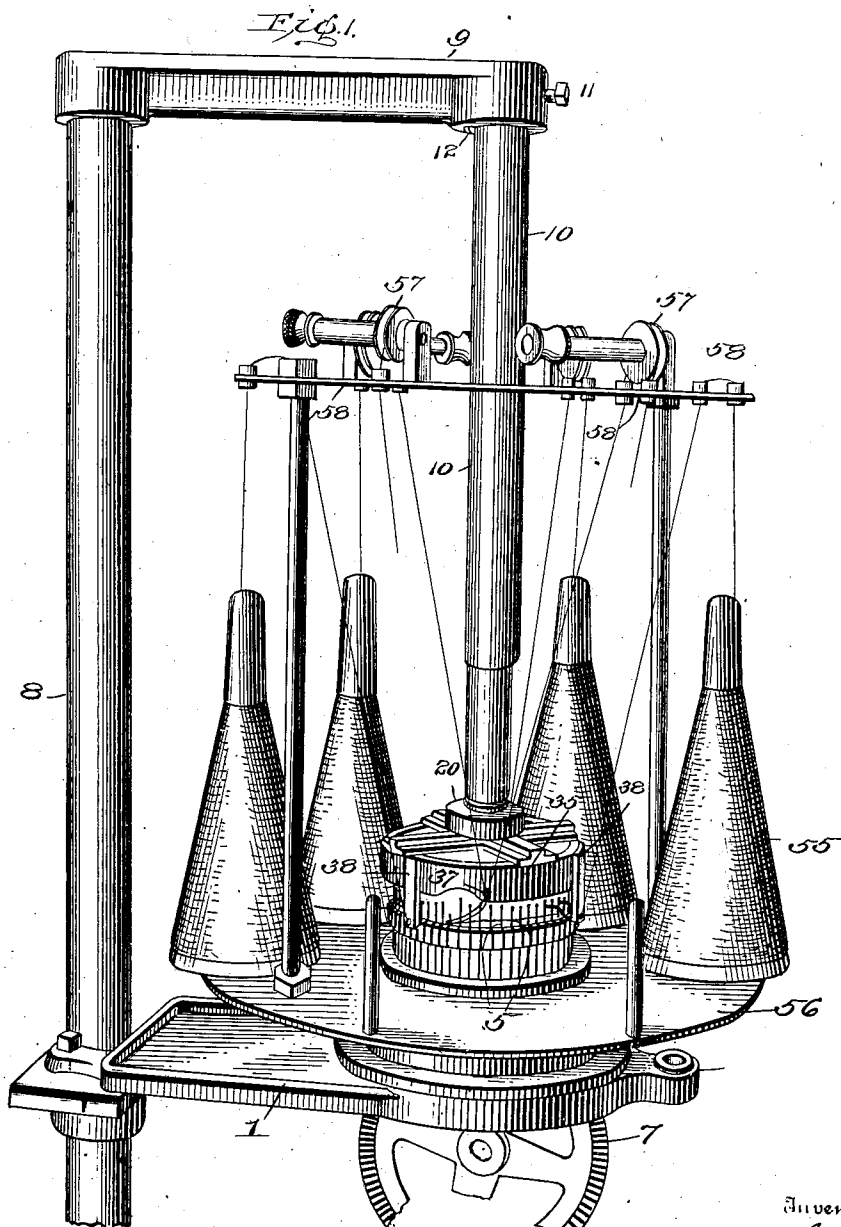


No. 810,578.

PATENTED JAN. 23, 1906.

B. T. STEBER.  
KNITTING MACHINE.  
APPLICATION FILED FEB. 1, 1905.

5 SHEETS—SHEET 1.



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Witnesses

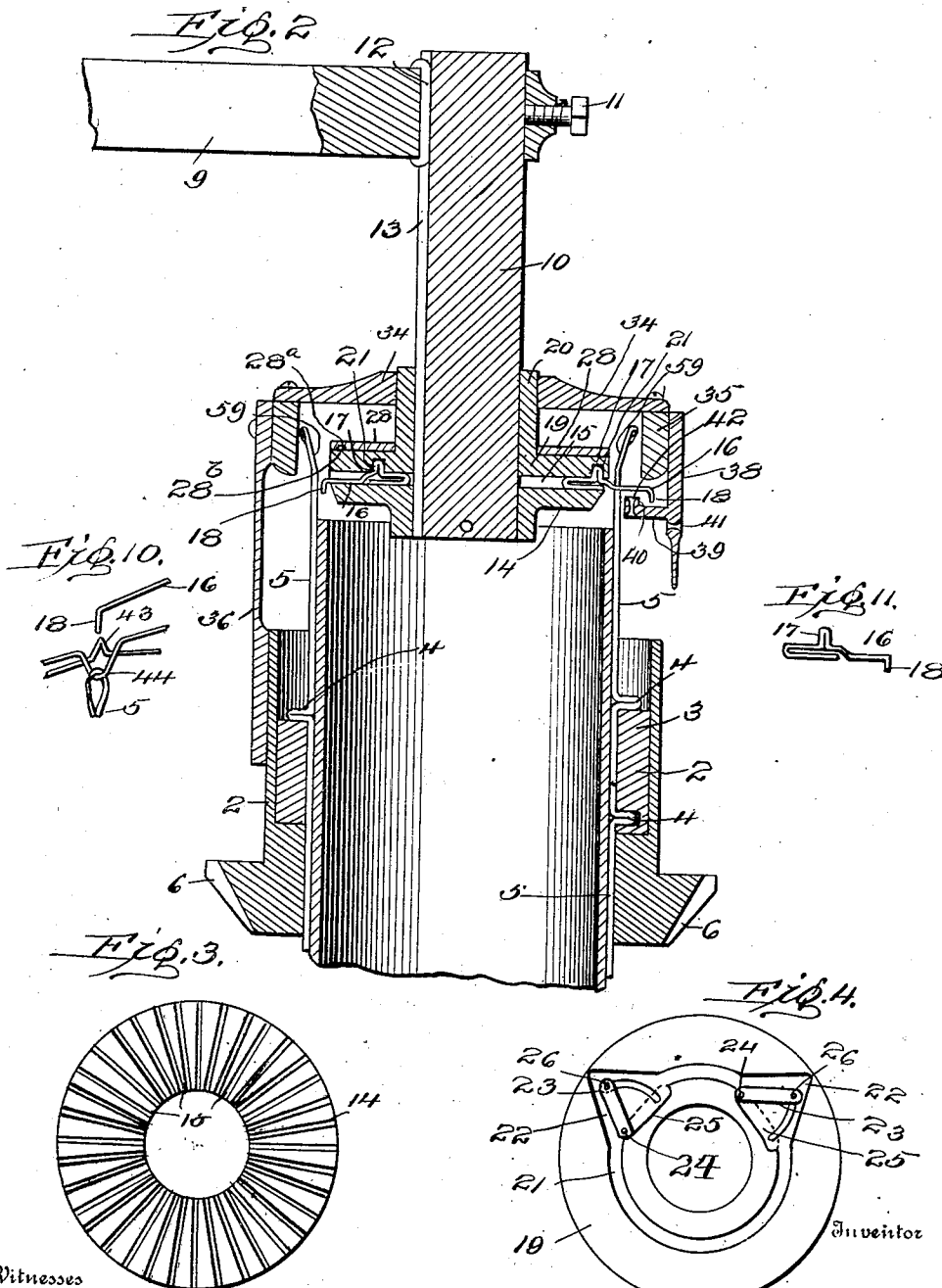
*J. M. Fowler*  
*Cassell Severance*

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5 SHEETS—SHEET 2.



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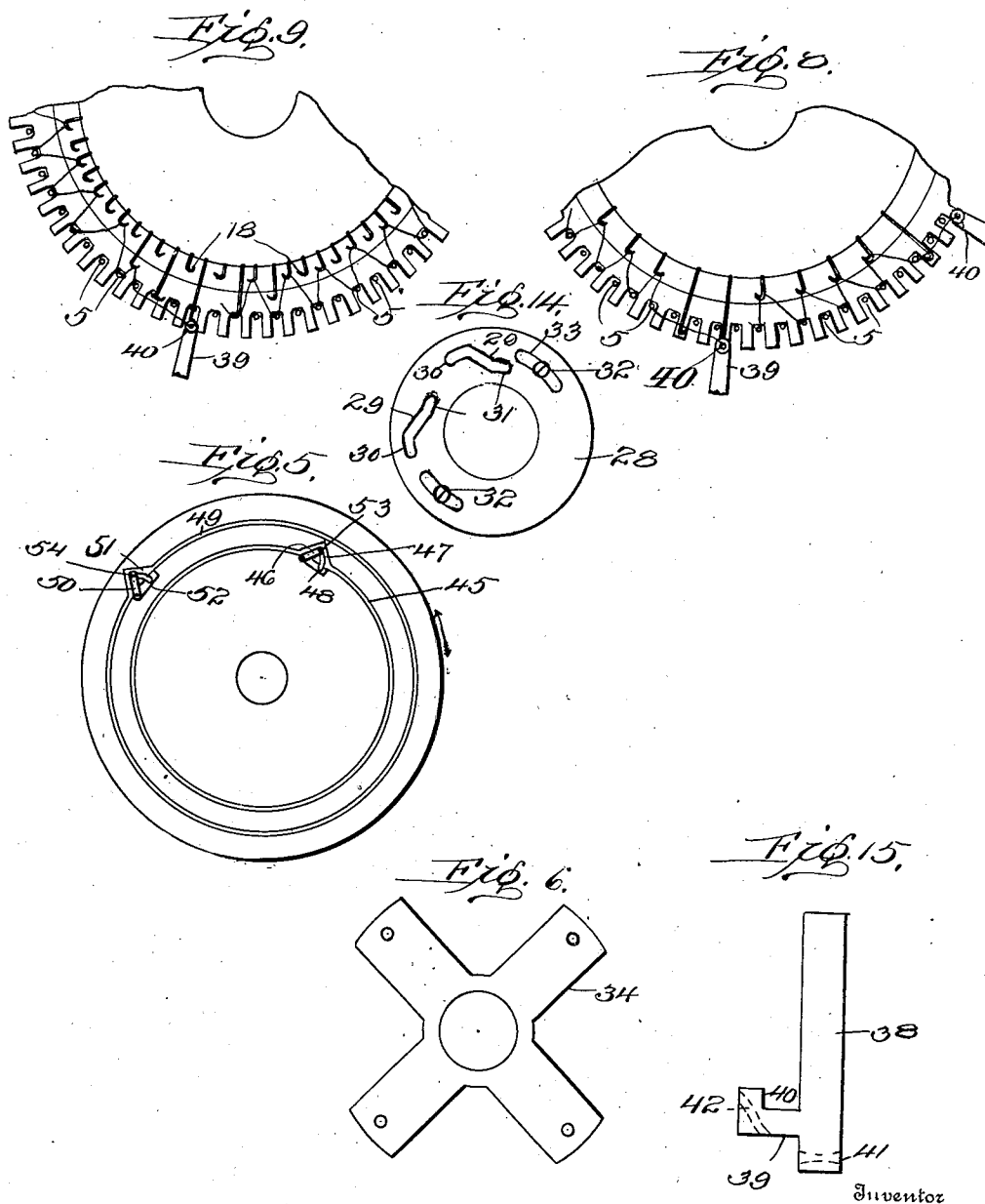
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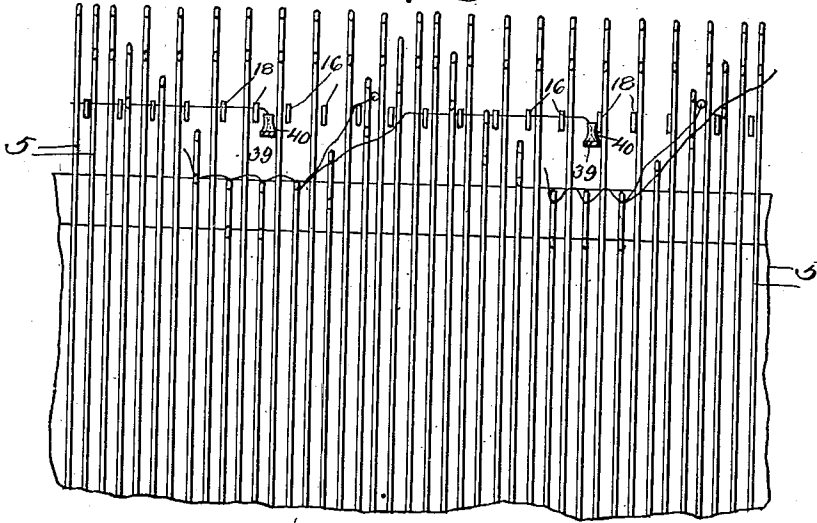
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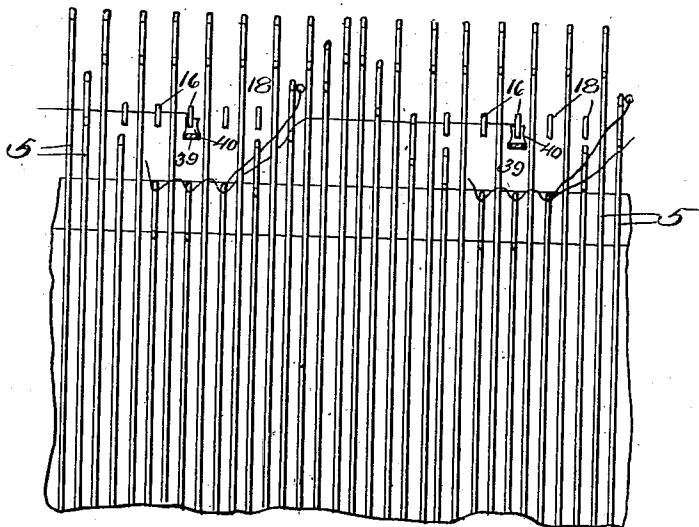
B. T. STEBER.  
KNITTING MACHINE.  
APPLICATION FILED FEB. 1, 1905.

5 SHEETS—SHEET 4.

*Fig. 7.*



*Fig. 12.*



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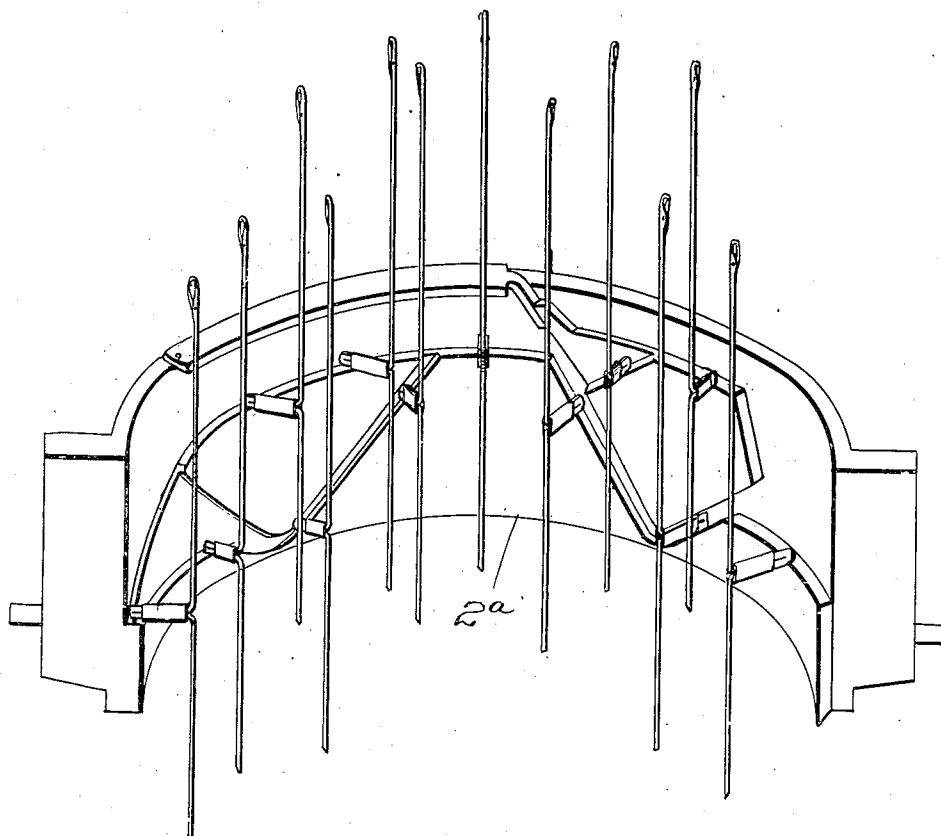
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APPLICATION FILED FEB. 1, 1905.

5 SHEETS—SHEET 5.

*Fig. 13.*



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# UNITED STATES PATENT OFFICE.

BERNARD T. STEBER, OF UTICA, NEW YORK.

## KNITTING-MACHINE.

No. 810,578.

Specification of Letters Patent.

Patented Jan. 23, 1906.

Application filed February 1, 1905. Serial No 243,709.

*To all whom it may concern:*

Be it known that I, BERNARD T. STEBER, a citizen of the United States, residing at Utica, in the county of Oneida and State of New York, have invented certain new and useful Improvements in Knitting-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in knitting-machines, and has special reference to such machines as are provided with vertically-operating knitting-needles.

It is the object of the present invention to so construct a machine that the needles may be caused to perform the knitting operation alternately while alternate needles between them are held temporarily stationary, after which the active needles are held temporarily stationary and the threads are caused to knit. In conjunction with needles thus alternately operating the invention contemplates a device in which laterally-operating hooks mounted within the circle of the needles are caused to pull within alternate sets of needles loops of a thread or yarn for forming loops or piles within the fabric.

The invention consists in certain novel constructions, combinations, and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 is a perspective view of a knitting-machine constructed in accordance with the present invention. Fig. 2 is an enlarged vertical central section through the cylinder of the machine and the support for the horizontally-moving hooks. Fig. 3 is a plan view of the dial-plate for holding the horizontally-operable hooks. Fig. 4 is an inverted plan view of the cam-holder for engaging the horizontally-moving hooks. Fig. 5 is a similar view, but showing the cam-holder provided with two hook-engaging paths of different diameters. Fig. 6 is a top plan view of the spider for holding the horizontal cam holder or plate. Fig. 7 is a side elevation of a portion of the needle-cylinder spread out into a flat condition and showing the relative positions of the needles and auxiliary yarn-engaging hooks, this being the preferable way when a very small needle-cylinder is employed. Fig. 8 is a top plan view of a portion of the needle-cylinder, the hooks being employed in

connection with a cam like that shown in Fig. 4. Fig. 9 is a similar view, but showing the hooks as operated by a cam like that shown in Fig. 5. Fig. 10 is a detail perspective view showing the auxiliary yarn pulled from a horizontal hook when the knitting-yarn is pulled by a vertical needle. Fig. 11 is a side elevation of a horizontally-moving hook. Fig. 12 is a view similar to Fig. 7, but showing the hooks arranged between temporarily stationary needles, this being the preferable arrangement of the parts when a sufficiently large needle-cylinder is employed to admit of the use of a dial and its plate sufficiently large in diameter to accommodate two different cam-paths for operating the hooks alternately. Fig. 13 is a detail view of the removable cam-section usually employed in the operation of the machine. Fig. 14 is a top plan view of the washer for operating the cams carried by the horizontal cam-plate. Fig. 15 is a detail view showing one of the brackets for delivering auxiliary yarn to the looping-hooks.

The subject-matter of the present invention is an apparatus which is capable of knitting various kinds of fabric where vertically alternately operating-needles are employed, and particularly where needles held in a cylindrical form are used for knitting cylindrical fabrics, horizontal hooks being used for drawing in or operating upon auxiliary yarns or threads which are used in connection with the main fabric. In this machine I employ horizontally-moving hooks, these hooks being moved in and out when desired for pulling in loops or properly disposing auxiliary yarn or threads for varying the inner face of a fabric by the addition of piles.

In the illustration accompanying this application I have shown a machine which is provided with a suitable bed-plate 1, supported in any suitable manner and having mounted upon it means for supporting a rotating cam-cylinder 2, which carries upon its inner face cams 3, having suitable cam-paths for engaging the heels 4 of the needles 5. The rotation of the cam-cylinder is accomplished in any usual and well-known manner—as, for instance, by providing it with a beveled gear 6, which meshes with an actuating beveled gear 7, which extends to a point below the bed-plate 1, where it is connected with operating mechanism. The cam-cylinder is preferably made with one or more removable sections, the removable section of

the cylinder carrying needle-operating portions of the cam-paths, the machine being preferably of the type shown and described by me in my previous United States Patent No. 753,645, and employing needles having long and short butts alternately arranged, although it is obvious that the same result, so far as the moving of the needles is concerned, can be obtained in other ways. The cam carried by the removable cam-section may be of any desired type and may be changed for effecting stitches and producing different fabrics in the machine, as clearly set forth in my patent referred to. I have shown at 2<sup>a</sup> in Fig. 13 of the drawings the cam, which I preferably employ when interknitting the supplementary thread in connection with the present machine and which is capable of operating the knitting-needles in different sets, so that the needles of each set are caused alternately to take yarn and to knit alternately between the alternate needles which are held up in a temporarily stationary position between them. Of course I do not wish to be understood as limiting myself to the use of this particular cam, since it must be evident that the vertically-operable needles may be used in connection with different kinds of cams to operate them alternately.

An important feature of the present invention is the manner of securing and operating the horizontally-moving hooks with respect to the vertically-moving needles. I have so constructed my improved knitting mechanism that the said horizontally-moving hooks are suspended by a fixed member within the upper ends of the vertical needles and are so held as not to interfere with the operation of any of the parts of the mechanism. In order to accomplish the desired result, I secure a standard or vertical support 8 to the framing of the machine and carry it a sufficient distance above the bed-plate to permit of the use of a horizontally or laterally extending supporting-arm 9. The inner end of the arm 9 is carried to a point above the center of the knitting-cylinder, and a depending rod or supporting-bar 10 is secured to said arm and extends to a point adjacent to the upper end of the needle-cylinder. The arm 9 is rigidly secured to the support 8, so as not to swing thereon, and the depending shaft or rod 10 is also rigidly secured to the arm 9, preferably by means of a set-screw 11 and a feather or key 12, which engages an elongated groove 13, formed in the depending shaft 10. The lower end of the shaft 10 extends downwardly within the upper ends of the vertically-moving needles a suitable distance to properly support the horizontal hook or needle dial 14, and it will be observed that the downward movement of the fabric is not obstructed by any lug inside the needle-cylinder, as is usually the case with other machines. I can lay in a supplementary thread without the use

of hooks; but when I wish to knit a fabric whose inner surface has piles I use hooks mounted in a dial to pull in the supplementary yarn in piles beyond the inner face of the cloth and will continue the description of the apparatus only mentioning the hooks. The upper surface of the dial 14 is provided with a number of radiating hook-receiving grooves 15. In each of said grooves a yarn-engaging hook 16 is mounted. These hooks may be formed in any desired manner; but are preferably made like the hooks shown in the drawings in Figs. 2, 10, and 11. As shown, such hooks are formed with their inner ends doubled or folded upon themselves, and at a short distance from the inner ends of said hooks the material of which they are formed is shaped into a heel 17, by which the hooks may be moved back and forth. The lower edges of the hooks are formed upon the same line or plane from end to end, so as to travel upon the floors of the grooves 15. The outer ends of the hooks are turned downwardly, as at 18, to form the yarn-engaging portions thereof. The dial 14 is supported at such a height upon the shaft or depending bar 10 that the hooks will be caused to move in and out between the upper ends of the vertical needles at a little distance below the hinged latches of the needles which are temporarily stationary.

Fitting upon the upper surface of the dial 14 is a cam plate or member 19, which is formed with a hub portion 20, surrounding the shaft 10, but loosely engaging the same, and a laterally-projecting flange portion, in which is formed one or more grooves 21. The under face of the cam-plate 19 is provided at suitable intervals with offset portions extending from the groove 21 or enlargements therein, as at 22, to accommodate the swinging or pivotal movement of cams 23. As shown in Fig. 4, when using only a single groove, as 21, in the face of the cam-plate I generally employ two cams 23, which are pivoted at their ends, as at 24, to the said cam-plate. When not held in their hook-engaging positions, the said cams fold into recesses 25, formed in the body portion of the cam-plate. When the cams are to actuate the hooks, they are moved outwardly upon their pivot-points, so as to occupy positions such as shown in Fig. 4. When in these positions, the cams have a space between them and the outer wall of the recesses 22 sufficient to permit of the passage of the hook-heels around the said cams, and thus the said hooks are caused to have a reciprocating movement when the cam-plate is rotated. Each of the cams 23 is provided at its free end with an upwardly-projecting pin or detent 26, by which the cams may be moved upon their pivots. To accommodate the movement of the pins or detents 26, the cam-plate is formed with segmental slots 27, which are struck from the pivot-points of the

cams as centers, and in this manner the said grooves will coincide with the line of movement of the pins 26 when the cams are swung back and forth. The movement of the cam is controlled and effected by a slide 28, which is fitted upon the upper surface of the cam-plate flange, as clearly shown in Fig. 2. The said slide is formed with inclined grooves 29, which connect short concentric grooves 30 and 31 at their outer and inner ends. The concentric portions of the grooves are made sufficiently long to hold the cam-pins positively in the positions into which they are brought. By moving the slide 28 upon the cam-plate the pins 26 may be made to travel from the inner ends 31 of the actuating-grooves through the inclined portions 29 to the outer concentric end portions 30 of said grooves. The movement of the pins thus effected causes the cams 23 to be thrown to their outermost positions for reciprocating the hooks 16. The movement of the plate 28 in the reverse direction from that just referred to will cause the drawing in of the cams by reason of the travel of the pins 26 to the inner ends 31 of the slots in the said slide. The slide 28 is movably held upon the cam-plate 19 by means of screws 32, which project through segmental slots 33, formed in the said slide 28. The slots 33 are made of sufficient length to permit of the movement of the cams to their innermost or outermost positions. The slide 28 is partially held in its extreme positions by means of small indentations or grooves 28<sup>a</sup>, which engage projecting lugs or detents 28<sup>b</sup>, carried by the cam-plate, and said slide is sufficiently thin to be sprung upon and off of the said detents 28<sup>b</sup>. The structure is such that the slide may be easily disengaged from one of the detents 28<sup>b</sup>, as it will yield sufficiently for movement upon or off the same when it is to be turned from one to the other extreme of its movement. Since the hooks are held against movement about the shaft 10 by reason of the dial being made fast to said shaft, it is necessary to rotate the cam-plate 19 in order to cause the reciprocation successively of the hooks. I therefore connect the cam-plate 19 with a rotating part of the machine. As shown in the drawings, the cam-plate is secured to a spider 34, which is connected at its outer ends with a yarn-feeding ring 35. The yarn-feeding ring is secured by one or more vertical standards 36 to the cam-cylinder 2. The rotation of the cam-cylinder thus effects the rotation of the yarn-ring, and the horizontal cam-plate engages the reciprocating hooks. The rotation of the cam-plate 19 operates to throw the hooks successively out, so as to engage auxiliary yarn fed to the machine, and then to move them inwardly again to make a loop of the auxiliary yarn inside the circumference of the knitted fabric fashioned upon the vertically-moving needles.

The yarn is fed to the vertically-moving needles through apertures such as shown at 37 in Fig. 1, the apertures in the ring traveling just ahead of the portion of the cam which depresses the alternate needles. When hooks 16 are employed in addition to the needles 5, one or more strands of auxiliary yarn or similar material can be fed to the machine by means of a guide bracket or arm 38, which is secured to the yarn-ring 35 and depends sufficiently below the same to reach beneath the ends of the dial-hooks. The brackets 38 are formed with inwardly-turned arms 39, having upwardly-projecting ends 40, through which the auxiliary yarn passes to the hooks. The body portion of the bracket 38 is extended below the arm 39 a sufficient distance to receive a yarn-guiding hole or aperture 41. The auxiliary yarn is thus led through the aperture 41 and thence through the aperture 42 in the end of the arm 39 and is in this manner led immediately beneath the hooks within their yarn-engaging hooked ends. There may be one or more of such brackets 38 secured to the yarn-feeding ring 35. I generally provide two of such brackets 38 for each set of cams, since when operating the vertical needles alternately the cam of the cylinder causes a depression of the alternately active needles in two different places—that is to say, one set of needles are first depressed for knitting and then the other set of alternate needles is caused to take yarn and is depressed for knitting, the first set then remaining temporarily stationary. The alternate raising and lowering of the two sets of needles may be accomplished in any suitable manner, but preferably by the employment of cams of different depths arranged to receive and guide the butts of the needles, the butts of one set of needles being longer than those of the other set, as seen in Fig. 13. The cam shown in Fig. 13 constitutes one set of cams, and in a large machine there will be as many sets as the circumference of the cam-ring will permit. The auxiliary yarn is fed to the hooks at points adjacent to the positions about the cylinder of the machine when the active vertical needles are depressed, as clearly indicated in Figs. 7 and 12 of the drawings. The auxiliary strand or strands of yarn are thus partially drawn upon the inside of the arc formed by the vertical knitting-needles in the form of projecting loops between the idle or temporarily stationary needles and the knitting-yarn which forms the fabric proper is brought down upon said loops and draws them from their hooks. The parts are so positioned that shortly after the loops, as 43 in Fig. 10, are drawn in by the hooks the knitting-needles descend, and the pulling tendency of a loop of knitting-yarn, as at 44 in said Fig. 10, will operate to pull the pile-loop 43 downwardly from the hook. The operation of the vertical knitting-needles



dles is not interfered with in the least by the operation of the hooks, for the hooks are arranged to play in and out between the temporarily stationary alternate vertical needles which are up and not knitting, and in Fig. 7 whether the needles are depressed or raised the said hooks will not be in their path

As seen in Fig. 8, the dial used, preferably in connection with small machines, contains one-half as many hooks as there are needles in the needle-cylinder, and the auxiliary strand is fed on the outside of all of the needles of the needle-cylinder, and the hooks carried by the said dial are thrust outwardly by suitable cams in order to pull in loops of the auxiliary strand. As above specified, the needles of the needle-cylinder are divided into two sets, one of which is drawn down into a knitting position while the other set remains raised and inoperative, and the loops drawn in by said hooks are drawn between the raised inoperative needles, and the auxiliary strand is thus given the form of a series of loops inclosing the inoperative needles and projecting into the knitting-cylinder and necessarily inside the fabric

In machines whose needle-cylinder is of a large diameter it is desirable at times to so mount the hooks and arrange the actuating-cam that the hooks may be operated alternately in the same manner that the needles are operated alternately. In order to bring the hooks centrally between the knitting-needles and to make the machine easier to be kept in adjustment, the hooks are actuated in different sets, as by a cam such as that shown in Fig. 5, each set occupying alternate positions with the other set. This does not vary the result in the formation of the fabric from the result produced by the structure shown in Fig. 8; but the machine is more easily kept in proper adjustment, because of the space on each side of each hook and between the stationary needles. When operating the hooks in alternate sets, the cam which actuates them is preferably formed with a plurality of grooves, as shown in Fig. 5. The said grooves are made concentric, the inner one, 45, having a cam 46, which operates in a recess 47 for actuating the hooks and which folds into a recess 48 when not in operative position. The outer groove 49 is also provided with a hook-operating cam 50, operating in a recess 51 and folding into a recess 52. Each of these cams is provided with actuating-pins, as 53 and 54, which project upwardly through the slots 27 in the cam-plate. The zigzag slots 29 formed in the slide 28 are the same as already described, with the exception that one is placed a little nearer to the periphery of the cam than the other. It will be evident that by this construction one set of hooks composed of every other hook in the circle may be operated by one cam, as 46, while the other set composed

of the other alternate hooks will be operated by the other cam 50. When using the double-grooved cam, the hooks may be arranged exactly opposite to the vertical needles, for the said hooks will only be thrust out to take yarn when the needles opposite them are depressed, as clearly indicated in Fig. 12.

As apparent from a glance at Fig. 1, it will be evident that the usual yarn-spindles 55 may be mounted upon the plate 56, which surrounds the needle-cylinder, and the usual tension device 57 may be supported above the said spindles by framing 58. In the actuation of the hook-engaging cam the addition of the spider 34 is not in the way and forms a simple means of connecting the said cam with the yarn-feeding ring 35.

It will be evident that the supporting of the auxiliary device within the needle-cylinder will not interfere in any way with the operation of the usual knitting-needles and that the auxiliary device may or may not be used, as desired, the hooks being kept out of operation by moving the hook-engaging cams into their recesses on the inner sides of the cam-grooves. The machine may thus be used for knitting circular fabrics of several kinds by using the cams as described in my previous patent above referred to. When it is desired to provide a nap of any kind upon the inner surface of the fabric knit, the hook-cams are thrown outwardly into their operative positions by a rotation of the annular slide 28, when the auxiliary yarn fed by means of the brackets 38 will be engaged by the hooks and drawn inside the range of the stitches knitted by the vertically-operating needles. In this way a succession of loops will be caused to project upon the inner surface of the fabric, and these loops may be cut or sheared, if desired, or left in the loop form, as preferred. If the auxiliary yarn be formed of material softly spun, the loops upon being napped will produce a fleece lining to the fabric.

It will be evident that the number of hooks employed in connection with the needles may be varied and that a small number may be used, as indicated in Fig. 8, or double the number may be employed, as shown in Fig. 9, and yet draw a loop back of every knitting-needle without departing in the least from the spirit of the invention.

As shown in Fig. 2, the upper ends of the knitting-needles 5 are preferably bent outwardly, as indicated at 59. This arrangement of the upper ends of the needles makes it possible to lay a loose thread back of the active needles of each series or set by simply laying the supplementary thread, in in front of or outside of the stationary alternate needles, after which the alternate active knitting-needles will after knitting as they rise come outside of the supplementary thread by reason of their tops being bent outward. The supplementary thread will then be held in a

corrugated circular line in front of or outside of one set of needles and back of or inside of the other set of needles, and as the needles knit in the regular hereinbefore-described manner this supplementary thread will be incorporated within the cloth about midway between its faces. This is especially useful in laying in elastic threads which it is not desired to knit with the needles, and a fabric provided with such elastic strands or threads is admirably adapted for use for surgical purposes. When using the machine for producing such an elastic fabric, the slide 28 is moved to one extremity of its limited action, so as to draw inwardly the hook-reciprocating cams. The hooks will thus not be operated, and the elastic or other loose thread or yarn may be laid in the fabric upon the inside of one set of alternate needles and the outside of the other set. When it is desired to form a fabric having a pile, the slide 28 is moved in the other direction, so as to throw the hook-engaging cams outwardly, and the operation will be accomplished as before described.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A knitting mechanism, whose needles knit alternately between raised needles, an auxiliary yarn-engaging mechanism suspended within the needles of the machine and operating between raised needles of the fabric-producing mechanism, comprising a dial, yarn-engaging devices on the dial and moving cam-engaging devices having movable cams mounted thereon, cam-operating detents projecting from the cams, a slide engaging the same for controlling the position of the said cams and means for raising the needles of the machine alternately.

2. In a circular independent-needle knitting-machine, means for projecting alternate needles up out of action, means for knitting with the alternate set of needles, means for causing these sets of needles to interchange their respective order of operations, and means for drawing loops of fleecing-thread between the shanks of all the needles raised up out of action.

3. In a circular independent-needle knitting-machine, the combination with a cylinder, and a stationary dial arranged within the same, of fabric-knitting needles carried by said cylinder, means for projecting alternate needles up out of action, means for knitting with the alternate set of needles, means for causing said sets of needles to interchange their respective order of operation, and means carried by said dial for drawing loops of fleecing-thread between the shanks of the needles raised up out of action.

4. In a circular independent-needle knitting-machine, the combination of a cylinder, needles carried thereby, cams for projecting alternate needles up out of action, and

for knitting with the alternate set of needles, said cams being formed for causing said sets of needles to interchange their respective order of operation, means for driving said needle-actuating cams, means for drawing loops of fleecing-thread between the shanks of the needles raised up out of action, and means driven by the cam-driving means for actuating said loop-drawing means.

5. In a circular independent-needle knitting-machine, the combination of driving means, means actuated thereby for projecting alternate needles up out of action, means for knitting with the alternate set of needles, means for causing said sets of needles to interchange their respective order of operation, a fixedly-supported shaft depending into the space surrounded by the needles, hooks supported by said shaft, means for actuating said hooks for drawing loops of fleecing-threads between the shanks of the needles raised up out of action, and means for communicating movement from the said driving means to said hook-actuating means.

6. In a circular independent-needle knitting-machine, the combination with a needle-cylinder, and needles operating vertically therein, of means for projecting alternate needles up out of action, means for knitting with the alternate set of needles, means for causing the sets of needles to interchange their respective order of operation, hooks for drawing loops of fleecing-thread between the shanks of the needles raised up out of action, and means for operating said hooks in alternation with respect to the active needles.

7. In a circular independent-needle knitting-machine, the combination with a needle-cylinder, and fabric-knitting needles carried thereby, of a dial arranged within the space inclosed by said needles, hooks carried by said dial and adapted at times to be projected beyond said needles for drawing loops of fleecing-thread between the shanks of the needles, and cams for alternately actuating alternate hooks.

8. In a knitting-machine, the combination with a cylinder, needles carried thereby, and a plurality of feeders for said needles, of means for projecting alternate needles up out of action, means for knitting with the alternate set of needles at every feeder, means for causing the sets of needles to interchange, and means for drawing loops of fleecing-threads between the shanks of the needles raised out of position.

9. In a circular independent-needle knitting-machine, the combination with a cylinder, and fabric-knitting needles carried thereby, of means for projecting alternate needles up out of action, means for knitting with the alternate set of needles, means for causing said sets of needles to interchange their respective order of operation, and means for laying a loose thread on the out-

side of one of said sets of needles and on the inside of the other set.

10. In a circular independent-needle knitting-machine, the combination with a cylinder, and fabric-knitting needles carried there-  
5 by, of means for projecting alternate needles up out of action, means for knitting with the alternate set of needles, means for causing said sets of needles to interchange their respective  
10 order of operation, and means moving about

said cylinder for laying a loose thread on the outside of the inoperative needles and on the inside of the operating-needles.

In testimony whereof I affix my signature in presence of two witnesses.

BERNARD T. STEBER.

Witnesses:

OWEN F. LEEKER,  
FRANK STEBER.